

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



10/5199U6



(43) International Publication Date
15 January 2004 (15.01.2004)

PCT

(10) International Publication Number
WO 2004/005814 A1

(51) International Patent Classification⁷: F25D 11/02,
17/06

(21) International Application Number:
PCT/BR2003/000084

(22) International Filing Date: 1 July 2003 (01.07.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PI 0202820-4 4 July 2002 (04.07.2002) BR

(71) Applicant (for all designated States except US): MULTI-
BRÁS S.A. ELETRODOMÉSTICOS [BR/BR]; Avenida
das Nações Unidas, 12995, 32º andar, 04578-000 São Paulo
- SP (BR).

(72) Inventors; and

(75) Inventors/Applicants (for US only): SCHMID, Alexan-
dre, Cury [BR/BR]; Rua Almirante Tamandaré, 157 -
apt.102, 89204-140 Joinville - SC (BR). CARGNIN,
Adriano [BR/BR]; Rua Victor Konder, 906, 89227-240

Joinville - SC (BR). MARQUES, Marco, Eduardo
[BR/BR]; Rua Orestes Guimarães, 421 - apt. 501,
89204-060 Joinville - SC (BR). RODRIGUES JÚNIOR,
Rogério [BR/BR]; Rua Bento Gonçalves, 225 - apt. 702,
89261-110 Joinville - SC (BR).

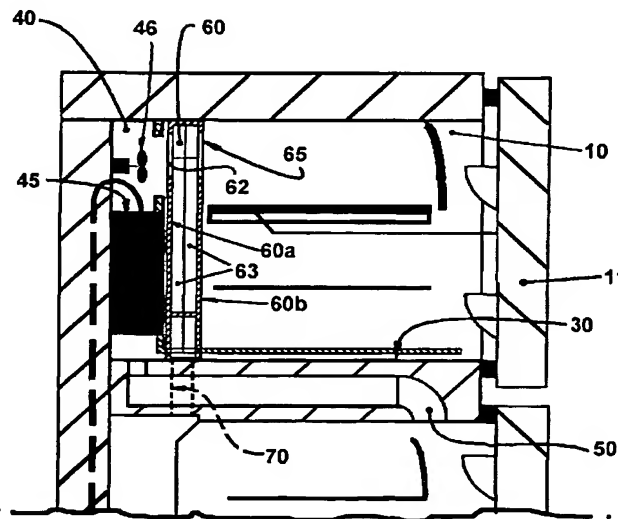
(74) Agents: ARNAUD, Antonio, M P et al.; Rua José Bonifá-
cio, 93 - 9th floor, 01003-901 São Paulo - SP (BR).

(81) Designated States (national): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BY, BZ, CA, CH, CN, CO, CR, CU, CZ,
DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM,
HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK,
LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX,
MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD,
SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG,
US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,
SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM,
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: AIR DISTRIBUTION SYSTEM FOR COMBINED REFRIGERATORS



(57) Abstract: An air distribution system for combined refrigerators of the type that comprises: a freezing compartment (10) and a refrigerating compartment (20); an air-cooling compartment (40) lodging at least one evaporator (45); a distributing duct (60) having a rear window (62) opened to the air-cooling compartment (40), at least one front opening (65) communicating with the freezing compartment (10) and one end opening (64) maintained in communication with the refrigerating compartment (20); and at least one fan (46, 47) producing a forced airflow from the air-cooling compartment (40) to the freezing compartment (10) and to the refrigerating compartment (20), said distributing duct (60) carrying a conduct (63), having a first end coupled to the end opening (64) of the distributing duct (60), and a second end selectively placed in fluid communication with one of the parts defined by the distributing duct (60) and by the air-cooling compartment (40).

WO 2004/005814 A1

**Published:**

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

AIR DISTRIBUTION SYSTEM FOR COMBINED REFRIGERATORS

Field of the Invention

The present invention is related to an air distribution system for combined refrigerators, with
5 forced airflow and presenting a freezing compartment and a refrigerating compartment separated by a divisional wall.

Background of the Invention

The combined refrigerators with forced airflow are
10 provided with ducts to conduct the cold air, which is coming from the evaporator, or evaporators, to the freezing and the refrigerating compartments.

In a known construction, as illustrated in figures 1 and 2 of the enclosed drawings, the combined
15 refrigerators with forced airflow comprise a freezing compartment 10 and a refrigerating compartment 20, which are superposed and provided with respective front doors 11 and 21, and separated by a divisional wall 30.

20 Inside the refrigerating compartment 20 are provided the usual shelves 22, between which is supplied the refrigerated air coming from front openings 23a provided in a diffusing duct 23, which is generally affixed internally to the central region of a rear
25 wall of the refrigerating compartment 20 and has an end, for example the upper end, receiving a refrigerated and forced airflow coming from an air-cooling compartment 40 lodging an evaporator 45 and a fan 46 and which is generally positioned close to the
30 rear region of the freezing compartment 10. The return of the air that circulates in the refrigerating compartment 20 back to the cooling compartment 40 is made by capturing said circulated air in the front upper region of the refrigerating compartment 20 and
35 conducting it to the air-cooling compartment 40

through one or more return ducts 50 provided in the interior of the divisional wall 30, or in any other adequate part of the structure of the refrigerator.

In the construction illustrated in figures 1 and 2,
5 the combined refrigerator comprises a single evaporator 45 and a single fan 46, and a duct system that comprises a distributing duct 60 disposed in front of the air-cooling compartment 40, from which it receives the refrigerated forced airflow that is
10 impelled by the fan 46, directing part of said forced airflow to the interior of the freezing compartment 10, through front openings 65 turned to the inside of the latter, and part of the forced airflow to the diffusing duct 23 through a connecting duct 70
15 generally provided through the divisional wall 30.

While being widely used in combined refrigerators, this prior art construction presents limitations which avoid improving the functional performance of these products and which are associated with their
20 refrigerated air distribution system, leading to the creation of more elaborated and efficient solutions.

One of the most efficient solutions, which is schematically illustrated in figures 3 and 4, comprises a single evaporator, such as it occurs in
25 the solution described above, and two fans 46, 47, one of which 46 being designed to supply a respective forced airflow to the freezing compartment 10, while the other fan 47 is positioned in the upper region of the diffusing duct 23, to supply an efficient forced
30 airflow to the refrigerating compartment 20. In this constructive variation, the second fan 47 receives the cold air coming from a refrigeration duct 80 directly connected to the air-cooling compartment 40.

In order to comply with the refrigeration requirements
35 of the respective compartments, to which the two fans

are operatively associated, said fans are coupled to the distributing duct 60 and to the refrigeration duct 80, which are specifically designed for this mounting arrangement.

5 In another prior art solution, which is an improvement of the arrangement having one evaporator and two fans, two independent refrigeration circuits are provided, one for each compartment and in which each circuit comprises one evaporator and one fan.

10 In this last construction (not illustrated), the forced airflow that is common to the two compartments is not provided any more and the air-cooling compartment is divided in two chambers, each of said chambers containing its fan and being associated,
15 through respective ducts, with one of the compartments of the combined refrigerator.

The constructive solutions mentioned above present advantages and disadvantages, taking into account some aspects, such as performance, cost, and food
20 preserving capacity. Thus, depending on the purchasing power of the consumers and the characteristics valorized in each market, the most adequate solution can vary considerably.

The different constructive solutions mentioned above
25 for the forced air distribution in combined refrigerators are specific and differ from each other, not only in relation to the number of fans and even of evaporators, but also and mainly in relation to the construction and disposition of the ducts for the
30 passage and direction of the forced airflow between each evaporator and the freezing and refrigerating compartments. The known constructive solutions make difficult and even unfeasible the different uses thereof, requiring considerable investments to
35 increase the portfolio of products.

In the construction that uses one evaporator 45 and one fan 46, the distributing duct 60 is constructed to receive the whole forced airflow from the fan 46 and to divide, so as to direct a part to the freezing
5 compartment 10 and another part to the refrigerating compartment 20, through a connecting duct 70, which is generally placed through the divisional wall 30, and through the diffusing duct 23.

In case of providing the same refrigerator with two
10 fans 46, 47, the distributing duct 60 is specifically constructed to receive the airflow from the first fan 46, directing it only to the freezing compartment 10, it being also necessary the construction of a refrigeration duct 80 to connect the air-cooling
15 compartment 40 directly to the connecting duct 70, to the end of which is mounted the second fan 47, which is responsible for providing a forced airflow to the refrigerating compartment 20.

In the third type of assembly foreseen herein, the
20 air-cooling compartment 40 is divided into two chambers (not illustrated), each containing one evaporator, one chamber being connected to the refrigeration duct 80 to define a forced airflow circuit to the refrigerating compartment 20, and the
25 other chamber is connected to the distributing duct 60, which is constructed to serve only the freezing compartment 10.

Each of said two assemblies requires one project for constructing the ducts, particularly for the
30 distributing duct 60 that is mounted generally in front of the air-cooling compartment 40.

Objects of the Invention

Since the known constructive solutions are not versatile to suffer alterations to obtain the
35 distribution of the forced airflow in combined

refrigerators, it is an object of the present invention to provide an air distribution system, which is capable, by making small alterations in a standardized duct element, to be easily adapted to the mounting conditions defined above, namely: one evaporator and one fan; one evaporator and two fans; and two evaporators and two fans, allowing the same duct arrangement to be applied to different needs and potentials of the final consumer.

It is a more specific object of the present invention to provide an air distribution system, such as mentioned above, which can be applied to different mounting conditions with the distributing duct presenting a standardized construction.

Summary of the Invention

The air distribution system for combined refrigerators is of the type that comprises a freezing compartment, a refrigerating compartment and an air-cooling compartment lodging at least one evaporator; a distributing duct having a rear window opened to the air-cooling compartment, at least one front opening communicating with the freezing compartment and one end opening maintained in communication with the refrigerating compartment; and at least one fan producing a forced airflow from the air-cooling compartment to the freezing compartment and to the refrigerating compartment, the distributing duct carrying a conduct, having a first end coupled to the end opening of the distributing duct, and a second end that is selectively placed in fluid communication with one of the parts defined by the distributing duct and the air-cooling compartment.

Brief Description of the Drawings

The invention will be described below, with reference to the enclosed drawings, given by way of example of a

preferred embodiment and in which:

Figure 1 is a schematic vertical cross-sectional view of a combined refrigerator with forced airflow, using the air prior art distribution system provided with one evaporator and one fan;

Figure 2 is a sectional view taken according to line II-II of figure 1, to illustrate the forced airflow outlets opened to the interior of the freezing and the refrigerating compartments;

Figures 3 and 4 are similar views to those of figures 1 and 2, respectively, but illustrating a combined refrigerator using a prior art air distribution system provided with one evaporator and two fans;

Figure 5 is a simplified schematic partial vertical view of the upper part of a combined refrigerator provided with the air distribution system of the present invention;

Figure 5a is a similar view to that of figure 5, but illustrating the air distribution system directly opened to the air distribution system with the diffusing duct;

Figure 6, 7 and 8 are perspective views of a first, a second, and a third way of using the air distribution duct of figures 5 and 5a; and

Figure 9 is a similar view to that of figure 2, but illustrating the combined refrigerator using the air distribution system of figure 8.

Description of the Illustrated Embodiment

As already mentioned, the present air distribution system is applied to a combined refrigerator with forced airflow, such as that described in relation to figures 1, 2, 3 and 4.

According to the construction proposed in the present invention, the distributing duct 60 takes the form of a parallelepipedic box, preferably made of injected

plastic material and presenting a rear basic portion 60a, in the form of a vertically disposed tray and with its rear wall 61 defining at least part of a front wall of the air-cooling compartment 40, and a front cover portion 60b to be seated and affixed against the rear basic portion 60a.

The distributing duct 60 is mounted inside the refrigerator cabinet, generally onto the divisional wall, separating the air-cooling compartment 40 from the freezing compartment 10, as illustrated in a simplified schematic manner in figure 5 of the enclosed drawings.

Regardless of the system used for the evaporation and for the forced airflow, the rear wall 61 of the rear basic portion 60a of the distributing duct 60 is provided with a window 62 axially aligned with a fan 46 that is mounted to produce a forced airflow from the interior of the air-cooling compartment 40 to the interior of the distributing duct 60 and through said window 62.

As better illustrated in figures 6, 7 and 8, the rear basic portion 60a of the distributing duct 60 contains, preferably incorporated in a single piece and in the internal side thereof, a conduct 63, the front wall portion being defined by the front cover portion 60b itself when assembled. The conduct 63 has a first end, generally the lower one, which is constantly coupled to an end opening 64, usually located in the lower region of the distributing duct 60 and to which is coupled an end of the connecting duct 70 that conducts the forced airflow to the diffusing duct 23 and from the latter to the refrigerating compartment 20.

The construction illustrated in figure 7 is of the type that uses only one evaporator 45 and one fan 46.

In this case, the whole amount of the forced airflow is produced by the fan 46 and passed through the window 62 to the inside of the distributing duct 60, wherefrom it is supplied to the freezing compartment
5 10 through front openings 65 provided in the front cover portion 60b.

In order to allow part of the forced airflow supplied to the distributing duct 60 to be conducted to the refrigerating compartment 20, the conduct 63 has a
10 second end, usually the upper one, which is usually closed during the molding step of the rear basic portion 60a, and which is cut when mounted into the cabinet, to define an inlet opening 66 that communicates the conduct 63 with the interior of the
15 distributing duct 60, allowing part of the forced airflow to be directed to the connecting duct 70 and thence to the diffusing duct 23 in the interior of the refrigerating compartment 20.

In the mounting arrangement using two fans, it is
20 necessary to establish a fluid communication between the air-cooling compartment 40 and the diffusing duct 23. In this case, the second end of the conduct 63 is maintained closed to the interior of the distributing duct 60, but a rear opening 67 is produced, by
25 rupturing a wall portion of the distributing duct 60, as illustrated in figure 8, to provide a fluid communication between the second end of the conduct 63 and the interior of the air-cooling compartment 40, allowing another fan 47, which is generally mounted to
30 an end region of the diffusing duct 23, to promote a forced airflow from the air-cooling compartment 40 to the refrigerating compartment 20, passing through the conduct 63, through the connecting duct 70, and through the diffusing duct 23.

35 In figure 6, a third manner of using the distributing

duct 60 is illustrated, to be applied to the arrangements using two fans 46, 47 and two evaporators (not illustrated), which are mounted generally side by side, each in a respective chamber. In this case, there is no connection between the interior of the conduct 63 and of the distributing duct 60, with the forced air circuit comprising another evaporator and another fan that are exclusively associated with the refrigerating compartment 20.

It should be understood that the physical disposition of the two evaporators could be made so as to allow the rear opening 67 of the conduct 63 to be in communication with the chamber that contains the evaporator of the refrigerating compartment 20, allowing the respective forced airflow to use the conduct 63 to connect the respective evaporator chamber to the connecting duct 70 and the diffusing duct 23.

In case the above arrangement cannot be accomplished, the distributing duct 60 is maintained with the construction illustrated in figure 6, and an additional duct (not illustrated) is provided to communicate the chamber of the evaporator of the refrigerating compartment 20 with the diffusing duct 23.

As it can be noted, a single standardized construction for the distributing duct 600 allows complying with the requirements of a forced airflow distribution in a combined refrigerator having one fan and one evaporator, or one evaporator and two fans, or even two evaporators and two fans.

In order to facilitate the adaptation of the distributing duct 60 to the different mounting conditions, the parts that will be selectively removed to form the inlet opening 66, and the rear opening 67

of the conduct 63 are preferably weakened or connected to the remainder of the distributing duct 60 by weakened connecting lines.

5 While the invention has been illustrated and described in relation to a preferred constructive form, it should be understood that changes could be made in the form and disposition thereof, without departing from the inventive concept defined in the claims that accompany the present specification.

CLAIMS

1. An air distribution system for combined refrigerators of the type which comprises: a freezing compartment (10) and a refrigerating compartment (20);
5 an air-cooling compartment (40) lodging at least one evaporator (45); a distributing duct (60) having a rear window (62) opened to the air-cooling compartment (40), at least one front opening (65) communicating with the freezing compartment (10), and one end
10 opening (64) maintained in communication with the refrigerating compartment (20); and at least one fan (46, 47) producing a forced airflow from the air-cooling compartment (40) to the freezing compartment (10) and to the refrigerating compartment (20),
15 characterized in that the distributing duct (60) carries a conduct (63), having a first end coupled to the end opening (64) of the distributing duct (60), and a second end selectively placed in fluid communication with one of the parts defined by the
20 distributing duct (60) and by the air-cooling compartment (40).
2. The air distribution system according to claim 1, characterized in that the conduct (63) is internal to the distributing duct (60).
- 25 3. The air distribution system according to claim 1, characterized in that the conduct (63) is incorporated to the distributing duct (60).
4. The air distribution system according to claim 3, characterized in that the distributing duct (60)
30 comprises a rear basic portion (60a) in the form of a vertically disposed tray, having a rear wall provided with a rear window (62) and defining at least part of a front wall of the air-cooling compartment (40), and a front cover portion (60b) to be seated and affixed
35 against the rear basic portion (60a) and being

provided with at least one front opening (65).

5 5. The air distribution system according to claim 4, characterized in that the front cover portion (60b) defines a wall portion of the conduct (63) when assembled.

6. The air distribution system according to claim 1, characterized in that the conduct (63) is maintained in selective fluid communication with one of the parts defined by the distributing duct (60) and by the air-cooling compartment (40) by means of respective front
10 opening (66) and rear opening (67) produced by the rupture of corresponding wall portions of the conduct (63).

7. The air distribution system according to claim 6,
15 characterized in that the conduct (63) conducts a forced airflow supplied, through the inlet opening (66), coming from the distributing duct (60)), to whose rear window (62) is operatively associated a fan (46).

20 8. The air distribution system according to claim 6, characterized in that the conduct (63) conducts a forced airflow, which is produced by a fan (47) that is operatively associated to the end opening (64) and to the refrigerating compartment (20), and which is
25 supplied by the air-cooling compartment (40) to the conduct (63), through the rear opening (67).

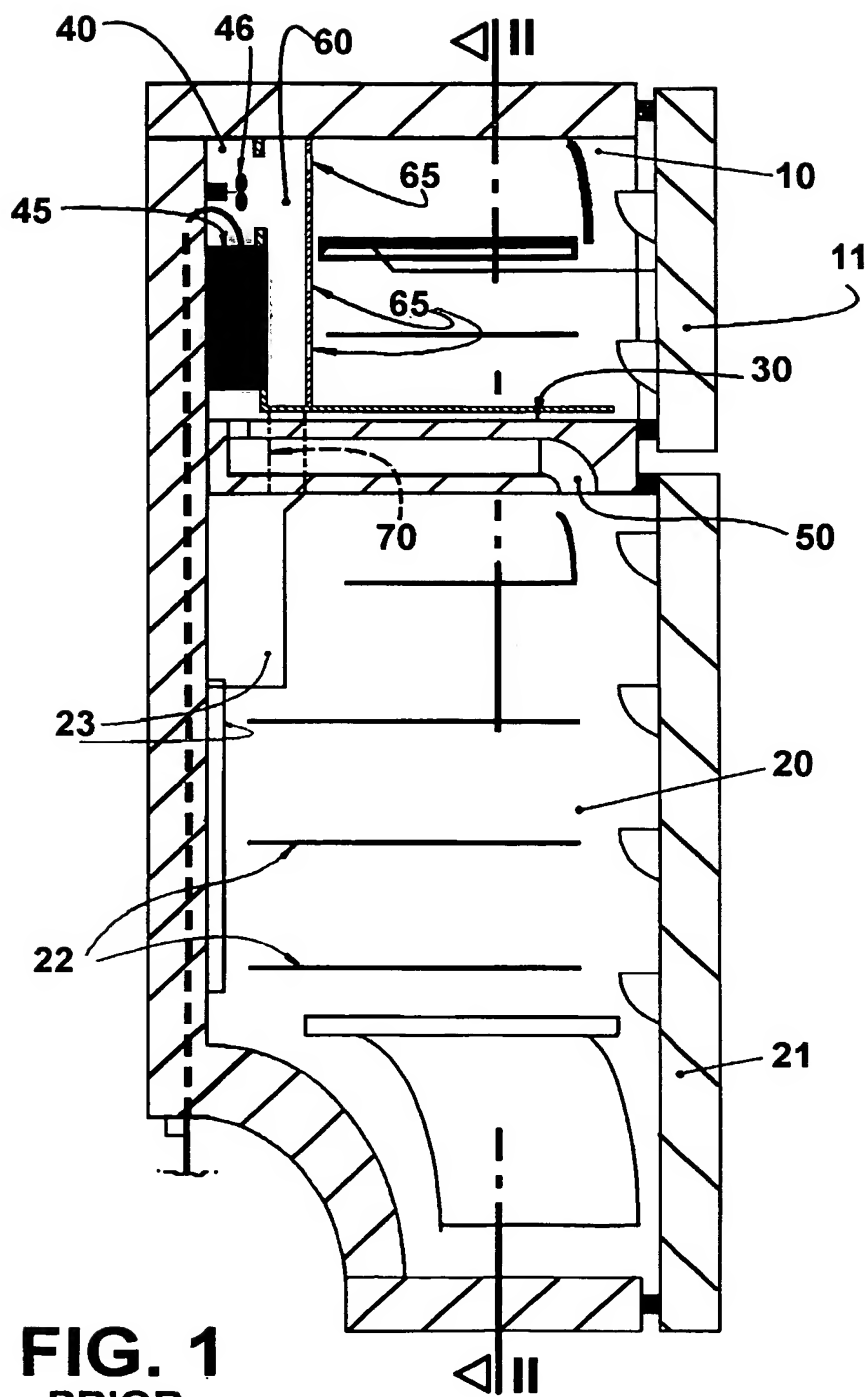


FIG. 1
PRIOR
ART

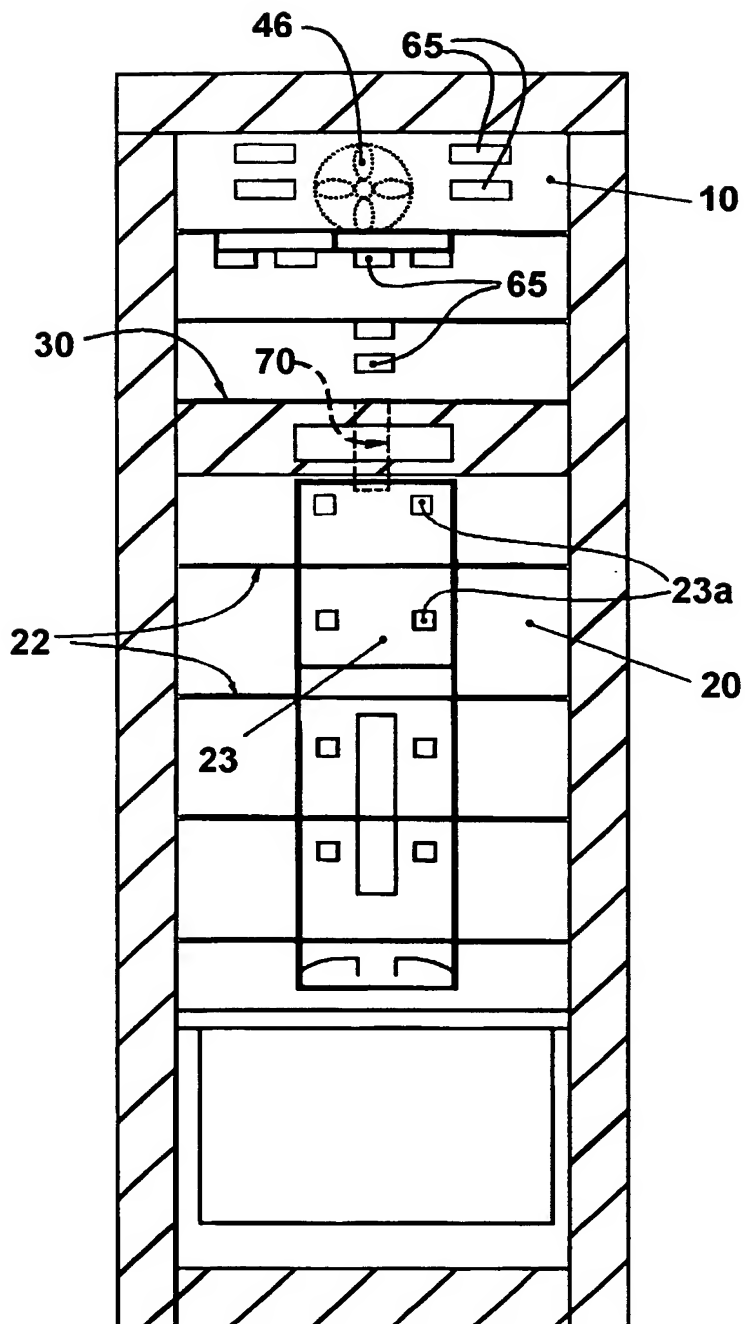


FIG. 2
PRIOR
ART

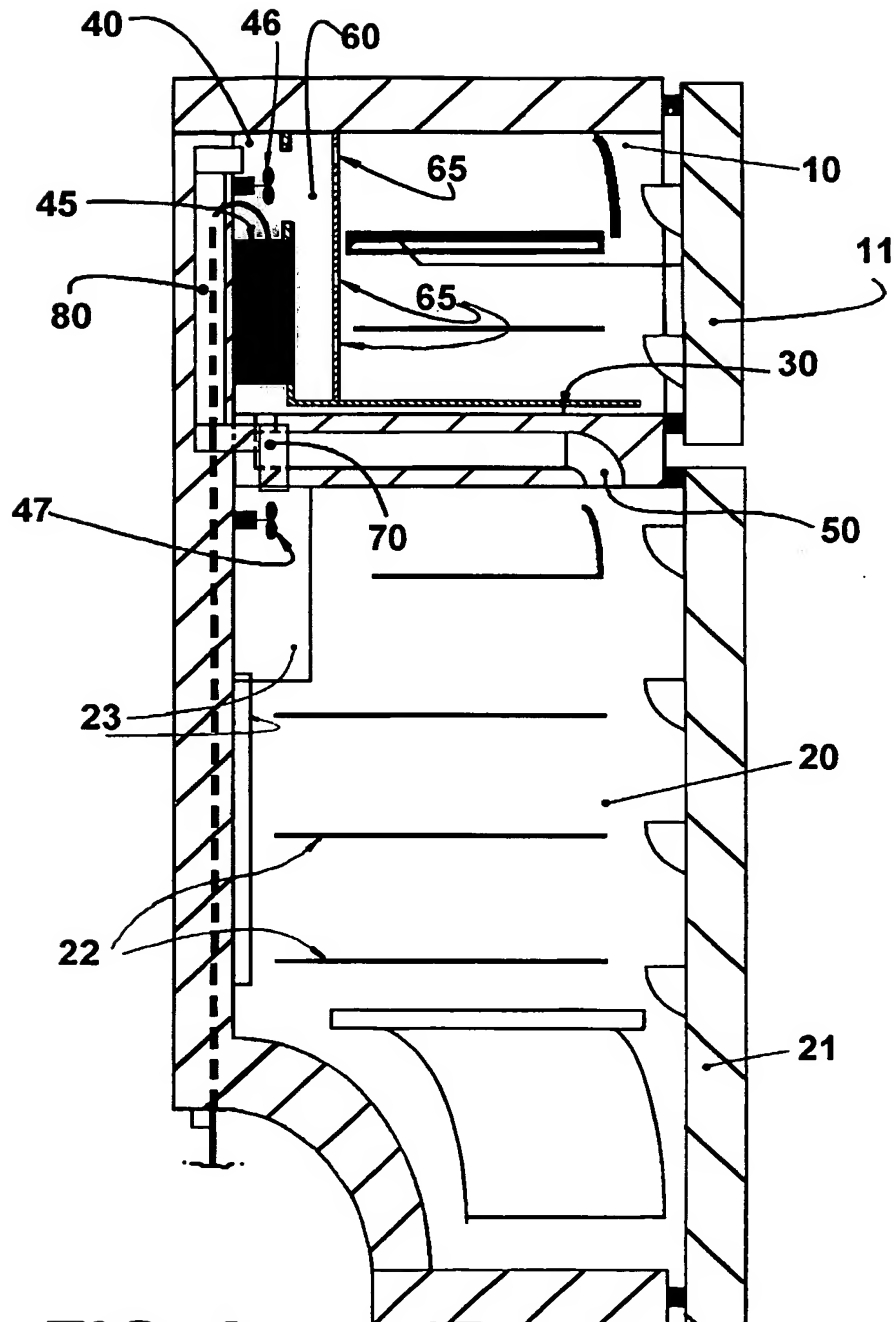


FIG. 3
PRIOR
ART

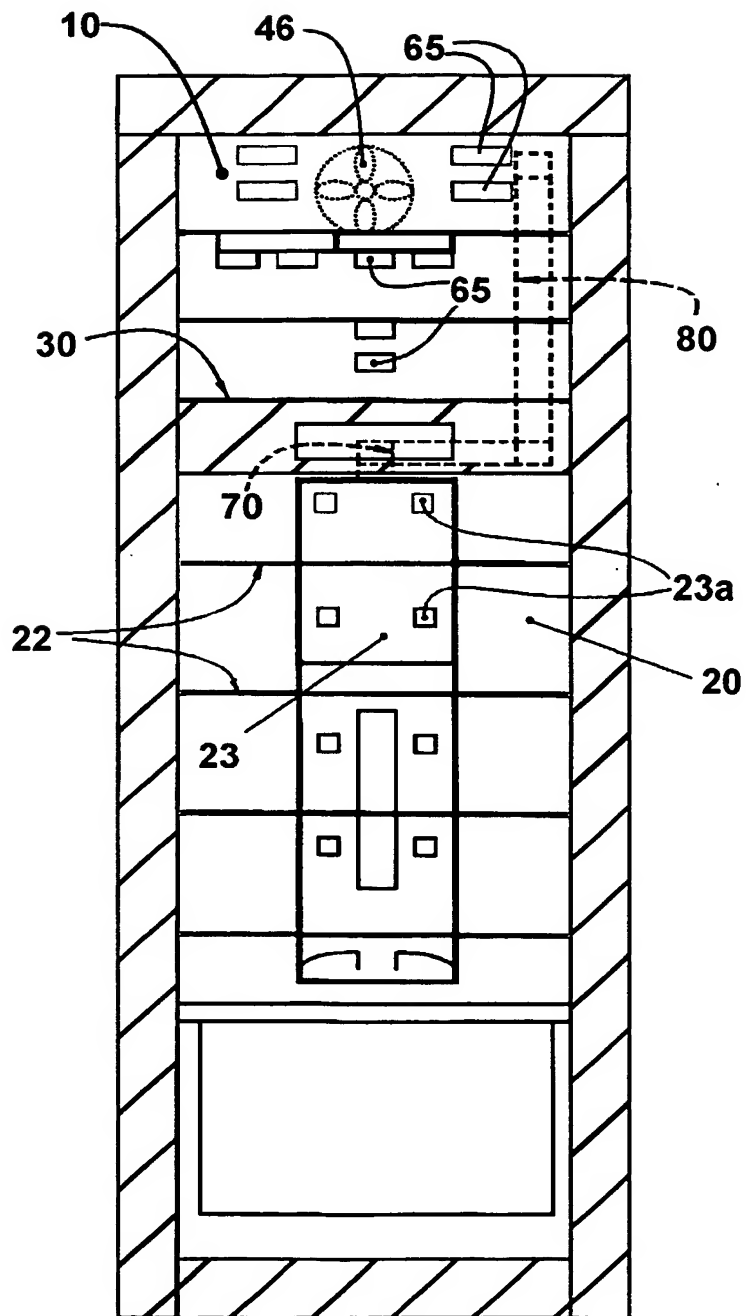
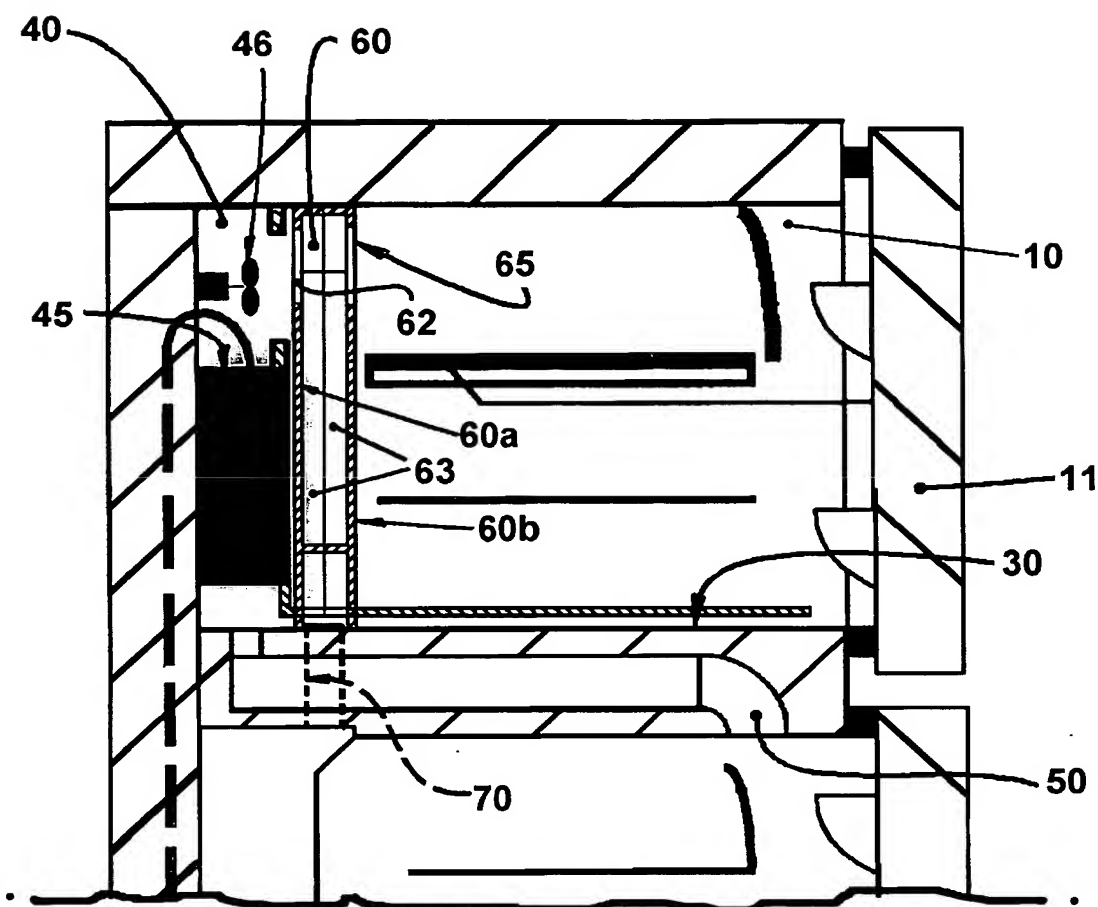


FIG. 4
PRIOR
ART

**FIG. 5**

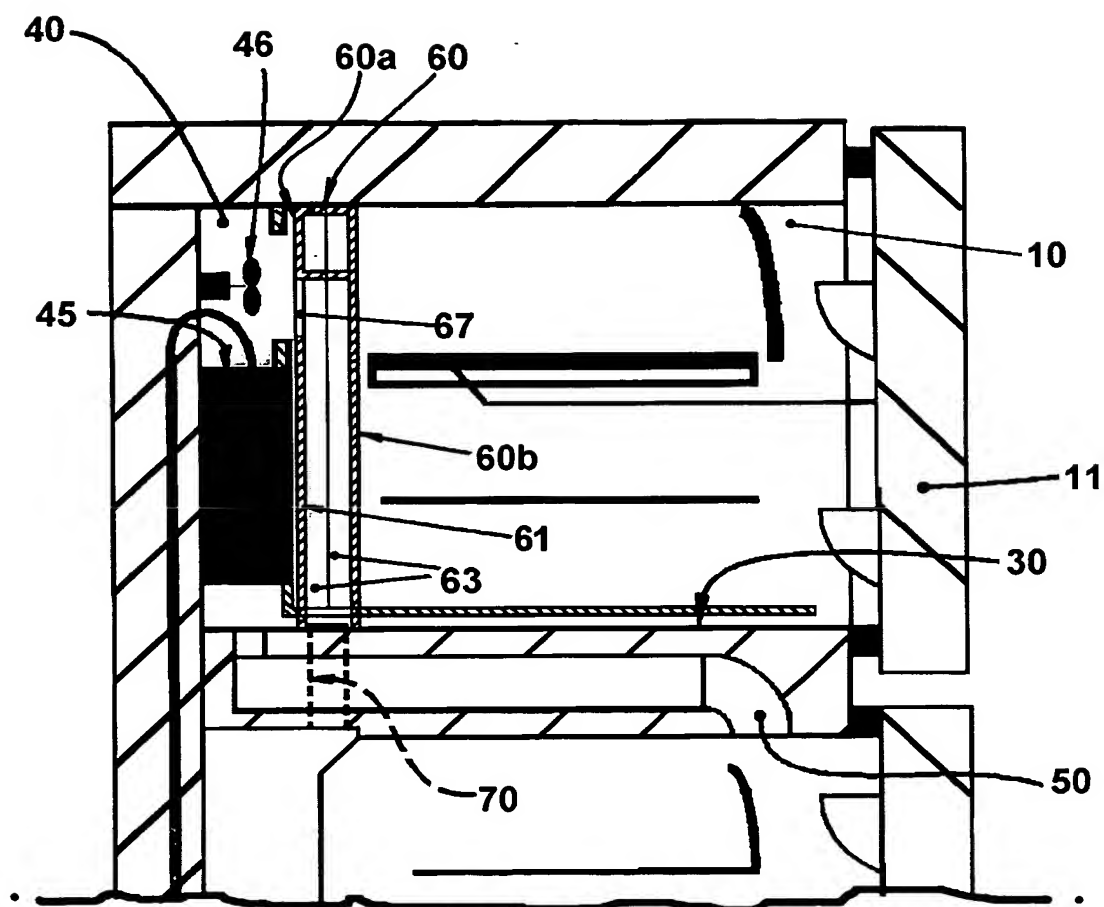
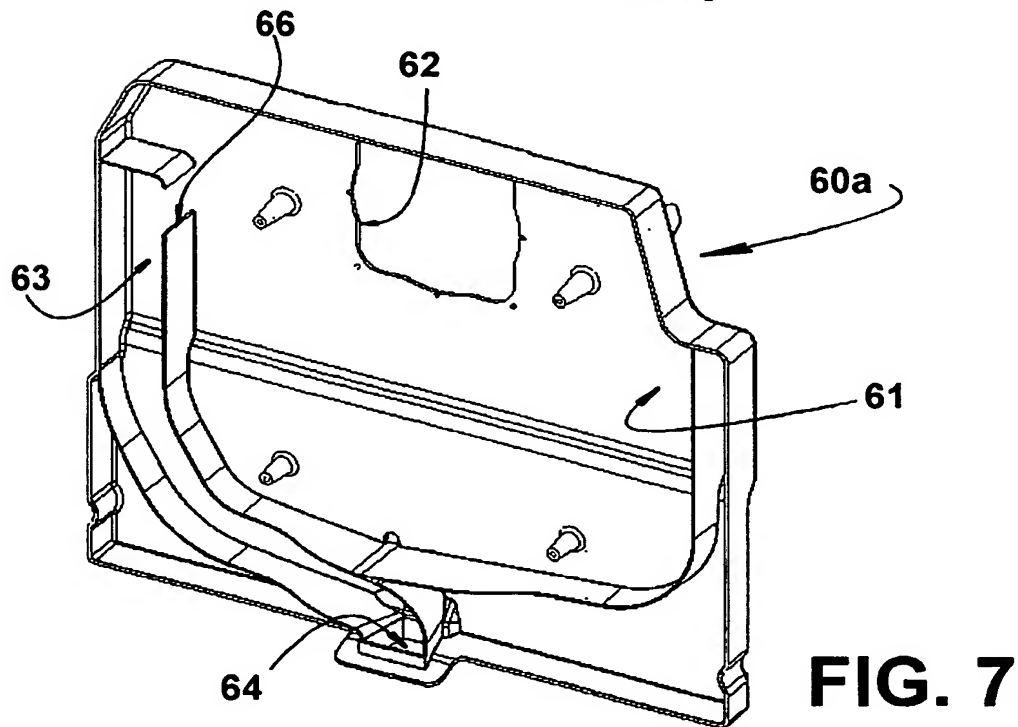
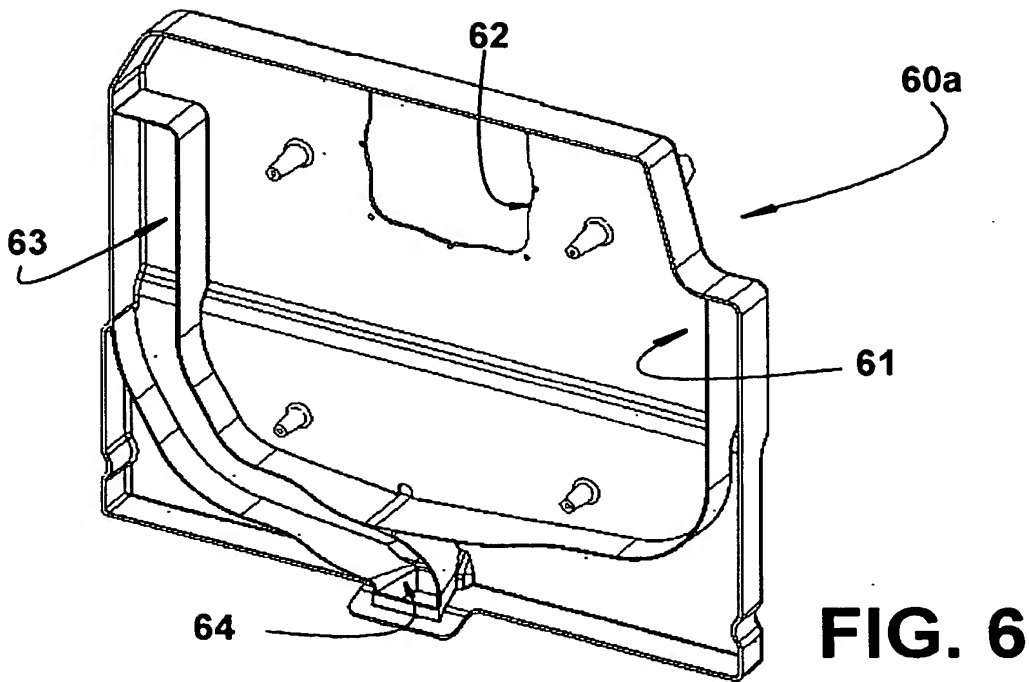
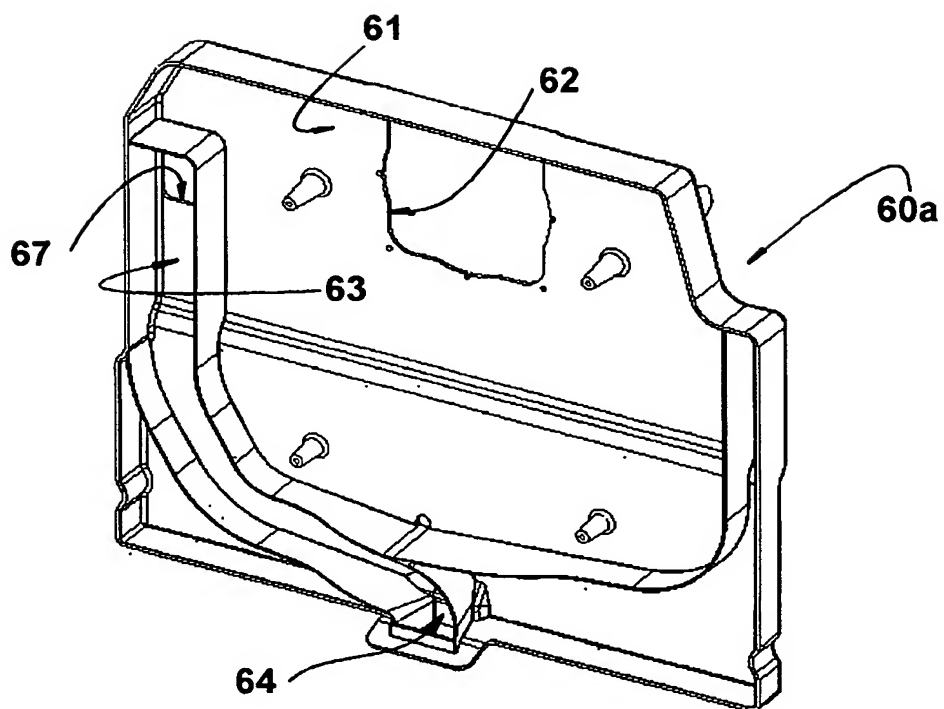


FIG. 5a



**FIG. 8**

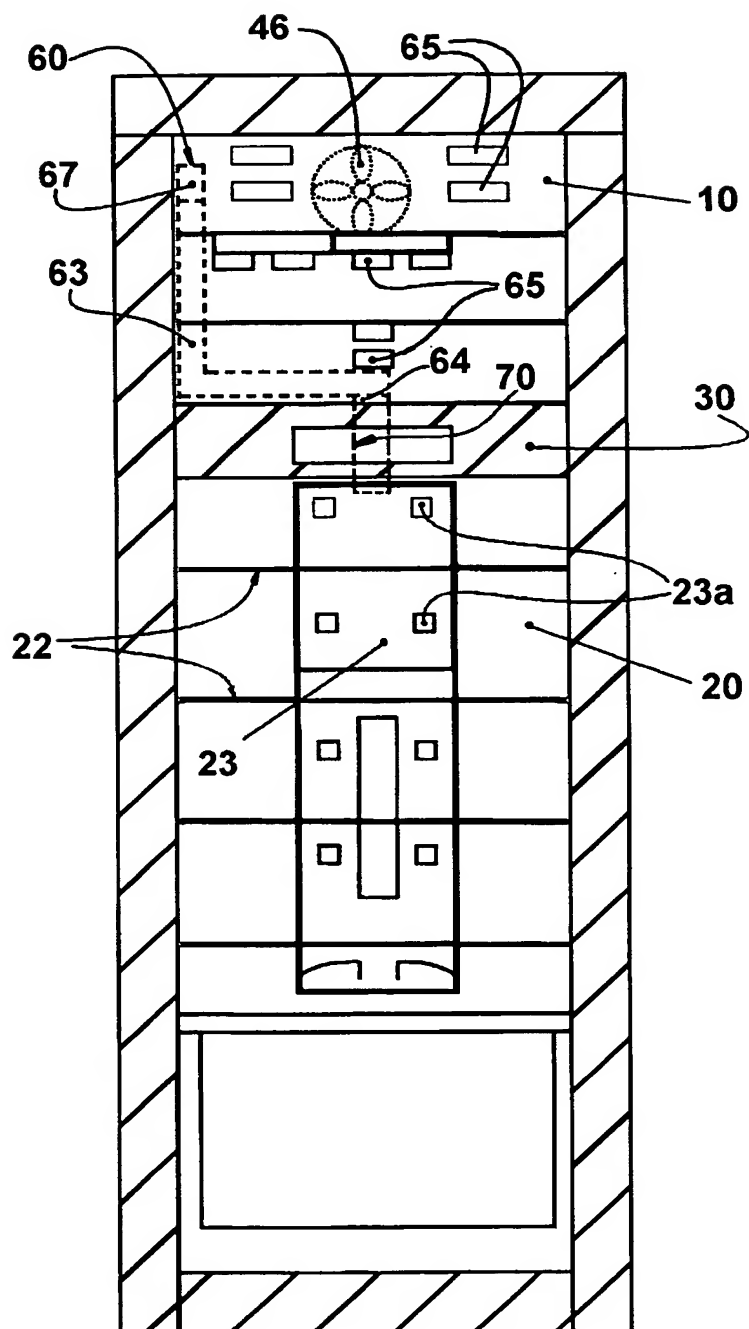


FIG. 9

INTERNATIONAL SEARCH REPORT

Internat. Application No

PCT/BE 03/00084

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 F25D11/02 F25D17/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F25D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 541 172 A (CANDY SPA) 12 May 1993 (1993-05-12) column 2, line 51 -column 4, line 25; figures 1-3 ---	1-3
X	US 5 704 224 A (CHOI JEONG MYUNG) 6 January 1998 (1998-01-06) column 4, line 65 -column 5, line 39; figures 5-8 ---	1-3
X	PATENT ABSTRACTS OF JAPAN vol. 015, no. 411 (M-1170), 21 October 1991 (1991-10-21) -& JP 03 170767 A (MITSUBISHI ELECTRIC CORP), 24 July 1991 (1991-07-24) abstract; figures 1-5,8-12,15 --- -/--	1,2

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

28 October 2003

Date of mailing of the international search report

04/11/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
 Fax (+31-70) 340-3016

Authorized officer

Boets, A

INTERNATIONAL SEARCH REPORT

Internati. pplication No
PCT/BP 8/00084

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 632 160 A (HARANGOZO MARTIN J ET AL) 27 May 1997 (1997-05-27) column 2, line 8 -column 4, line 52; figures 1-6 ----	1-5
A	US 4 920 765 A (MCCAULEY MICHAEL J ET AL) 1 May 1990 (1990-05-01) column 2, line 49 -column 7, line 31; figures 1-11 ----	1,3-5
A	US 5 875 642 A (BYON HO-JAE ET AL) 2 March 1999 (1999-03-02) ----	
A	US 5 076 070 A (SHINOBU YOSHIHARU ET AL) 31 December 1991 (1991-12-31) ----	
A	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 09, 31 July 1998 (1998-07-31) -& JP 10 096577 A (MATSUSHITA REFRIG CO LTD), 14 April 1998 (1998-04-14) abstract ----	
A	JP 62 288468 A (MITSUBISHI ELECTRIC CORP) 15 December 1987 (1987-12-15) -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/BR/00084

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0541172	A	12-05-1993	IT 1251989 B DE 69211813 D1 DE 69211813 T2 EP 0541172 A2	27-05-1995 01-08-1996 07-11-1996 12-05-1993
US 5704224	A	06-01-1998	KR 162411 B1 AU 700533 B2 AU 6816596 A CN 1152105 A ,B DE 19641498 A1 GB 2306212 A ,B IT MI962101 A1 JP 9184672 A	18-02-1999 07-01-1999 17-04-1997 18-06-1997 24-04-1997 30-04-1997 13-04-1998 15-07-1997
JP 03170767	A	24-07-1991	JP 1991391 C JP 7006731 B	22-11-1995 30-01-1995
US 5632160	A	27-05-1997	NONE	
US 4920765	A	01-05-1990	NONE	
US 5875642	A	02-03-1999	KR 159699 B1 CN 1174318 A ,B JP 2880145 B2 JP 10054643 A	15-01-1999 25-02-1998 05-04-1999 24-02-1998
US 5076070	A	31-12-1991	JP 2061227 C JP 2242065 A JP 7101141 B DE 4008012 A1 DE 4042373 C2	10-06-1996 26-09-1990 01-11-1995 27-09-1990 21-04-1994
JP 10096577	A	14-04-1998	NONE	
JP 62288468	A	15-12-1987	JP 1813098 C JP 5020665 B	27-12-1993 22-03-1993